



Payloads Human Factors Team Established

By Mike Horkachuck

In the Fall of 2002, the ISS Payloads Office continuing effort in process improvements spawned a team to review the payload process for Human Factors requirements verification, the Human Factors Implementation Team (HFIT).

The purpose of HFIT is to streamline the Human Factors requirements verification process. It does this by providing, as a service to the payload developers, a detailed review of the payload hardware for compliance with Human Factors requirements. The ultimate goals of the process are building astronaut-friendly products and obtaining a Certificate of Compliance (CoC) with all applicable requirements. Section 3.12 of SSP 57000 (The Pressurized Payload Interface Requirements Document or IRD) defines the requirements that must be met by the payload hardware to allow effective human interaction with the payload during on-orbit operations.

Previously, payload developers performed all the requirements verification themselves. Verifying that the hardware meets these requirements has become a costly task, one that has resulted in numerous waivers during the final review of the hardware (before and during KSC testing or bench review activities). A review of payload waivers to IRD requirements shows that nearly 50 percent of the waivers are due to human factors violations. The HFIT hopes to eliminate the need for these waivers by reviewing the hardware with the payload developers earlier in development and recommending needed changes (or approving the current configuration as is).

The HFIT consists of civil servants and contractors (Boeing and Lockheed-Martin) from JSC and KSC. The team includes human factors engineers and labeling specialists as well as Astronauts and other crew office representatives. HFIT has been empowered by the Payload Engineering Control Panel to interpret human factors requirements, to evaluate and approve payload compliance with these requirements, and to waive minor deviations from the requirements when appropriate.

The HFIT was first put through its paces during a trip to the Marshall Space Flight Center to perform Human Factors compliance inspections of two payloads of widely differing complexity. The first payload reviewed was the Low Temperature, Low Thermal Energy Carrier (LoTEC), which is being developed at the University of Alabama in Huntsville (UAH). HFIT met with the payload developers at the UAH facility. A complete hardware review for compliance with IRD requirements revealed three minor open issues, two of which were verified and repaired within two days. The third issue was resolved later and closed when the payload developer sent a photograph to the HFIT. All parties agreed that this payload review was very successful. The lead of the LoTEC payload team, UAH Professor Dr. Francis Wessling, was very impressed with the ease of the process and the openness of the HFIT to discuss and resolve non-conformances. Dr. Wessling attended the subsequent ISS Payload Office 6-sigma meeting and provided positive feedback on the HFIT process.



HFIT member examines LoTEC human interfaces

The second payload review took place on the Observable Protein Crystal Growth Apparatus (OPCGA) and associated support flight equipment. The OPCGA hardware was developed by Teledyne Brown Engineering (TBE) in Huntsville and by the University of California. This payload was more complicated than the LoTEC, and so required a full day of HFIT review. There were several requirements discrepancies, but after much discussion with the payload developer the HFIT members determined that these issues were acceptable without hardware

(see HFIT page 5)

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From the friends of Lesa Roe

ED: We regret that all contributions could not be included due to space requirements.

Farewell, O' Lesa

Tho' Grief and Fondness in my Breast rebel,
When promot'd Lesa bids the town farewell,
Yet still my calmer Thoughts her Choice commend,
I praise the Leader, but regret the Friend,
Resolved at length, from Heat and Houston far,
To breathe in distant Fields a purer Air,
And, fix'd on Hampton's solitary shore,
Give St. Virginia one true Texan more.

J-D (with apologies to Samuel Johnson)

We will truly miss Lesa's leadership in the Payloads Office as she goes off to her new challenges at Langley Research Center. Our loss is truly Langley's gain, and I know her leadership and vision will be much appreciated there... Lesa, we appreciate your leadership and the legacy you leave in the Payloads Office. We wish you much success leading change at Langley Research Center.

Jennifer F. Comella

We lament the recent transfer of Lesa Roe to Langley Research Center...although a great loss to the ISS Program and its research community, in the spirit of OneNASA, she will now be able to share her many talents with another NASA Center. Lesa has brought tremendous leadership to the ISS Payloads Office throughout her tenure there, initiating numerous payload integration improvements, elevating the visibility of research within the ISS Program and most recently, devoting her time, energy, and experience to a critical Agency initiative, the Station and Shuttle Utilization Reinvention (SSUR) Team. In all areas, she has proven to be a strong advocate for and true friend of research - she will be missed by all of us in the research community. We wish her and her family all the best in their new environment at LaRC and only hope that our paths will cross again - soon!

Tom St. Onge, Microgravity Science Division,
Glenn Research Center

It has been a pleasure working for you. Your professionalism on the job is an inspiration to us all. Knowing that you handle all of us, then go home and handle twins is just remarkable. I wonder if you would ever admit which group is harder to handle?????????

Best of Luck on Everything!

JoEllen Riley

Two years ago our home was severely flooded during Tropical Storm Allison. We were very touched by the help we received from several people. However, the significance of what Lesa did only became apparent to me much later.

The time demands for cleanup and relocation would have easily exceeded the leave I had available. Lesa brought this problem to the attention of personnel, which resulted in the implementation of a liberal leave policy benefiting us as well as others in the same situation.

Going home for Christmas has always been something we look forward to and although leave was still very tight throughout the remainder of that year, I ended the year with a couple of days to use during the holidays. This would not have happened if Lesa had not intervened. Although there are many positive things that can be said about Lesa's skill as a manager, I will always remember her for this.

Gene Cook

Lesla Roe took the reins of OZ during a very difficult time. Facing deep budget cuts, declining onorbit crew time availability, uncertain organizational future, reduced upmass allocations, and a frequently critical oversight committee responding to a frequently critical community of Payload Developers/ Principal Investigators, she stepped up to the challenges with aplomb and confidence. Now, two years later, even with the difficulties ensuing from the loss of Columbia, the ISS payloads community has a stable budget and program, significantly improved relations with both oversight committee and customers, and ... direction for responding to current challenges... Looking back, it is clear that Lesa's leadership and management - two very different but invaluable and unfortunately rare skills - were the key to making all this happen. To put it mildly, she will be missed...

Jeff Durham

Lesla, I very much enjoyed working with you. Thanks for your support in helping to make the Code M Research Program Office successful and my job a lot easier, despite the unique circumstances and the additional help from OZ we sometimes needed. I value our friendship, and as you proceed with your new assignment in LaRC please give me a call if I can be of help in some future activity (I have a number of good friends at LaRC from years past).

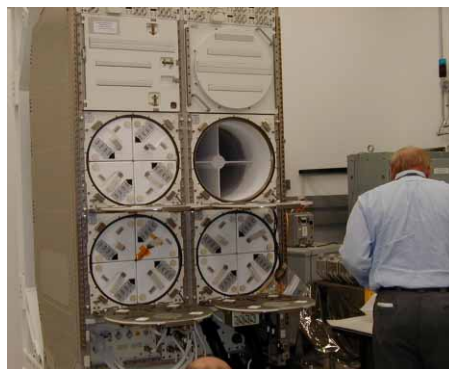
Al Holt

Cold Stowage to Save Critical Research

By Mike Horkachuck

The Payloads Office (OZ) has been developing refrigerator/freezers for general payload use for many years. The very first Change Request (they were called Design Decision Packages back then) for the ISS program was support for large MPLM-based freezers to support science and crew food. In this DDP, science requirements were collected in four standard temperatures: +4°C, -20°C, -80°C and -180°C. The temperatures originally were selected by the science community to resemble the capabilities of equipment found in a ground-based laboratory. The +4°C refrigerator temperature was to be used for samples which could not tolerate being frozen. The -20°C temperature is similar to standard ground freezers and is what many previous Spacelab and Middeck units provided. The -80°C temperature is basically the freezing point for CO₂ (dry ice) and was suggested as the preferred temperature for bulk storage of samples for more than three months. The previously used -20°C was observed to allow too much chemical change in the sample over long periods of time. The -180°C freezer was reserved for small samples of some of the most sensitive type. A snap freezing function was required that would allow cell ultra structure analysis to be preformed postlanding. The need for large quantities of samples at ISS assembly complete favored the use of an active MPLM, allowing the Shuttle middeck to be used by live specimens and very time critical and sensitive science.

Today, only the MELFI and the CRYOSYSTEM are planned for active MPLM resupply. These are much larger freezers than have been flown before. MELFI, the Minus Eighty degree Laboratory Freezer for ISS, is a full rack-sized unit, which contains approximately 300 liters of cold volume. As it's name suggests, it was the unit that was to fulfill the -80°C requirements. As the design progressed, ESA and their contractor Astrium, Toulouse, recognized that the Brayton system in



Ground checkout of MELFI reveals the capacity of the open dewar.

MELFI could also be used to provide other temperatures. The four dewars (cold volumes) of MELFI allow for one or two to be at +4°C and/or -20°C when the others are at -80°C. The CRYOSYSTEM is in development and can hold up to 880 samples in 2-milliliter vials, or 550 samples in 5 ml vials, or a combination. The system also provides a snap tool and vial, which can bring a small sample from room temperature to -180°C in less than one second. Normally, when water is frozen to ice, it expands. This very fast freezing transitions water molecules to a point on water's phase diagram that does not let water expand during freezing; thus not rupturing the walls of plant and animal cells.

To continue to support the evolving science and operational needs for freezers, OZ has been developing and collecting other freezer systems.

- ARCTIC, a +4°C, -20°C unit was developed from the Next Generation Thermal Carrier project to provide an interim capability until the MELFI program could overcome some development setbacks.
- Cellular Biotechnology Cryodewars (CBC) have been procured to provide some small quantity of passive, -180°C transport capability to and from ISS in about ½ of a middeck locker.
- KSC dewars provide a larger internal



volume for passive -180°C transport, but take up a double middeck locker when this additional volume is needed.

- LoTEC, developed by the University of Alabama at Huntsville, is a passive +4°C refrigerator. Built of composite materials, it uses Aerogel insulation and fills a single middeck locker.

A larger liquid nitrogen dewar system and even a dry ice system for passive transport in the MPLM have been explored and continue to run into challenges in meeting the allowable gas release requirement to avoid popping the relief valves on the MPLM and other



LoTEC passive refrigerator

safety concerns.

Upgrades to all of these passive systems are in development to allow them to function as transport devices at other temperatures, with more payload volume or in the MPLM.

GLACIER is a new freezer to provide science with -180°C in sample sizes other than the 2 and 5 ml vials and will have relaxed freezing and hold requirements compared to CRYO.

Additional details of each of the freezers will be provided in future articles as well as lessons learned and information about how to request use of some volume in the cold stowage fleet for your science samples. Further information about integration in the cold stowage fleet is available at the following website:

<http://iss-www.jsc.nasa.gov/ss/issapt/payofc/OZ2/ColdStow.html>

ISS Payload Requirements: A Necessary Evil?

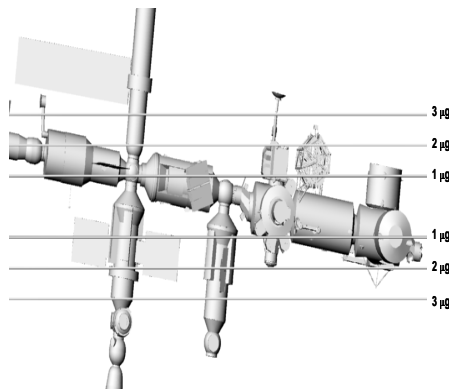
Mike Danford

Project Manager, EXPRESS Integration

A comment often received from ISS Payload Developers is "ISS integration requirements are more extensive than previous Shuttle programs and are complicating the payload design process". In this article, some of the contributing factors will be discussed.

Perhaps the single biggest contributor to the growth of integration and design requirements for ISS Payloads is the enhanced resource capability provided by the ISS vehicle and multi-user payload facilities such as the EXPRESS racks. Payload accommodations onboard the ISS have been significantly expanded beyond those in the Shuttle middeck and include both Ethernet and RS-422 data interfaces, complete command uplink and telemetry downlink capability, heat rejection via the moderate and low temperature water loops, vacuum exhaust, gaseous nitrogen supply and vibration isolation capabilities. Unfortunately, with additional capabilities come additional requirements to ensure compatibility between the payload design and the vehicle/rack interface. The ISS Program has focused significant resources on efforts to maximize the ratio of accommodations to complexity. In addition, the level to which requirement compliance must be duplicated for follow-on flights has been minimized. This provides a substantial benefit for research programs involving multiple flights or extended duration investigations.

In addition to the expanded set of payload accommodations, the unique capabilities provided by the ISS as a long-term microgravity science platform necessitate the definition of unique requirements, such as those associated with limiting microgravity disturbances. Protecting the microgravity environment requires the identification of payload operations or modes that may adversely impact the microgravity environment and verification that this impact has been limited to allowable levels.



Some elements not shown

Projected microgravity environment for ISS at assembly complete.

Other areas affected by the special considerations that apply to a long-term orbiting facility are acoustics and human factors. Long term exposure of crew members to the continuous and intermittent noise sources on-board has been shown to cause at least short term hearing damage with more serious damage a real possibility. In addition, the extended exposure to potential hazards dramatically increases the criticality of ensuring the ability of the crew to detect caution and warning annunciations alerting them to off-nominal conditions.



During development of the EXPRESS rack strategic placement of acoustic foam (white) was required to reduce operational noise.

Human Factor considerations are driven by the long-term interaction between ISS crewmembers and the human interfaces of ISS payloads. This requires special consideration be given to methods for ensuring the successful operation of the payload hardware. Also, given that crew-tended operations comprise a major portion of the service provided to users, human interfaces must be carefully managed in order to ensure payload requirements can be met to the greatest extent possible.

Maintenance-type operations that are planned for repeated execution have the potential for adding significantly to the crew workload and have therefore been specifically addressed in order to maximize the crew time available for scientific research. Although these constraints have increased the number of Human Factors requirements levied on payloads, the ISS Payloads Office has responded to concerns by establishing a Human Factors Implementation Team (HFIT). This team is available to assist Payload Developers with implementing the requirements in their payload design, as well as providing a simple, straightforward method for verifying compliance. Response from users thus far has been extremely positive.

In summary, the enhanced capabilities offered by the ISS are unique from any previously offered to microgravity investigators. The benefits of these capabilities are significant, but come at the expense of additional payload requirements. A careful balance between the requirements necessary to ensure crew safety, successful support of a broad spectrum of microgravity research and the effort expended by Payload Developers is the goal of the ISS Program. By achieving that goal, we can ensure the rewards and research potential far outweigh the effort required to utilize the ISS research platform.

Want Help with Parts Selection?

By Tom Taylor

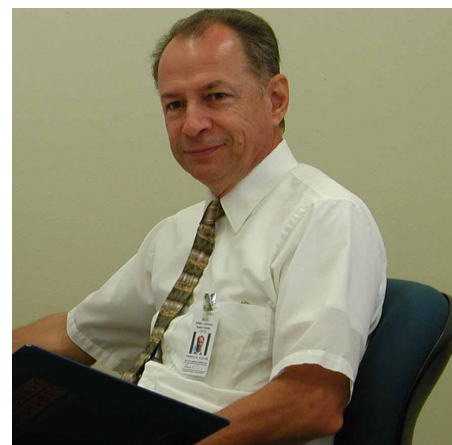
Thanks to the Payload organization, code OZ, additional funding has been granted to the EV5 Electrical, Electronic and Electromechanical (EEE) parts group of JSC serving the interests of hardware reliability in the area of proper EEE parts selection and assembly processes. The Flight Hardware Development Branch, EV5, has undertaken the mission of providing answers in the form of direct guidance, suggested contacts at JSC, written materials and web links to designers of any ISS payload. Although direct guidance can include design overview and commentary to assure parts match for the intended application, guidance is most often directed at the areas of parts derating, EMI reduction techniques, ionizing radiation susceptibility testing and the identification of program documents for consideration. Additional services include a review of parts selections to see if records show any history of problems and to identify parts in need of the additional screening that assures payload mission success. These and other services available to any payload project offer the advantages of a third party viewpoint, utilization of experienced resources paid for by the OZ office as well as a measure of confidentiality.

EV5 services include:

- EEE part selection and guidance

- Review and guidance on EEE parts derating
- Printed circuit board review to IPC standards
- Screening considerations for both part and box level
- Providing radiation susceptibility testing of components and assemblies
- Joint collaboration with safety personnel on mitigation of parts and design issues
- Supporting design reviews
- Reliability predictions
- Production of evaluation reports for the selected parts

The EEE parts group can help facilitate failure investigation, a service that is generally available at no cost. Some of the services available at JSC are Particle Impact Noise Detection (PIND), Destructive Physical Analysis (DPA), microscopy and X ray examination of failed parts as well as component evaluation in accordance with the test protocol of military standards. The EEE parts group frequently uses this service to facilitate the qualification of new parts as well as parts to be used in applications beyond their originally intended range. These initiatives provide the payload developer with the increased confidence



required to assure success of the payload mission and realization of the science it needs.

The quality of a payload hardware and the time left for testing can frequently suffer with the pressures of schedules, limitations of budget and absence of confident answers. This condition is arrested with the early establishment of a communication link between payload developers and the EEE parts group. Information provided by this link will in turn reduce total payload cost in the form of less rework and fewer delays. The EEE parts personnel have at their disposal years of experience with their foremost goal being an interest in helping to ensure the success of payload hardware. Again, a key attribute of this service is an assumption of the cost of this experience by the payload office.

HFIT

(continued from page 1)

modification. This negated the need for any waivers.

A debrief was held with the HFIT and the OPCGA payload developers to discuss the few open Human Factors items awaiting verification and to develop a plan for closing these items. This payload review was highly successful, and the payload developer lead, Jeff Howard, also provided positive feedback during the 6-sigma meeting.

Following the success of its first outing, HFIT next reviewed an International Partner payload. This was the Perceptual-Motor Deficit in Space/Test of Reaction and Adaptation Capabilities

(PMDIS/TRAC), a Canadian Space Agency payload designed to evaluate changes in motor function and reaction time due to microgravity. On March 3, 2003 HFIT did a hardware review at JSC that went quite well and ended with approval of 90% of the payload hardware. During a subsequent visit to Winnipeg, Canada, HFIT members completed the review process, and on May 18th the payload was issued its requirements completion form.

HFIT has also conducted training at KSC to include Vehicle Integration Test Team (VITT) and KSC payload processing personnel in the HFIT process. This should assist both VITT and payloads during Crew Equipment Interface Tests (CEIT) and bench reviews.

For the five payloads that have been reviewed by HFIT thus far, a total of 22 exceptions were avoided, ranging in topic from color to electrical connector pin identification. Two key factors have made this reduction in exceptions possible. First, HFIT's involvement early in the development process has made it much easier for PDs to make changes to the hardware without major impact to cost and schedule. Second, the participation of crewmembers as integral members of the HFIT has facilitated problem resolution and the approval of waiverable conditions.

If you have a NASA sponsored payload in development and want to see if you could benefit from HFIT, please contact your PIM to set up further discussions.

Expedition

By John Uri

Despite a reduced crew and limited transport resources, the Inc. 7 crew has been accomplishing science in several key areas. Three of the Microgravity Science Glovebox (MSG) payloads already had samples and processors on-board when the Columbia tragedy occurred. The In-SPACE, begun during Inc. 6, was completed early in Inc. 7. The CSLM investigation processed one of two samples on-board in an engineering test. PFMI is now continuing its processing of 15 samples. Additionally, EarthKam, CEO, and HLS activities have been completed, and with the MSG investigations, are described below.

InSPACE (Investigating the Structure of Paramagnetic Aggregates from Colloidal Emulsions)

The purpose of this investigation is to obtain fundamental data of the complex properties of an exciting class of smart materials termed magneto-rheological (MR) fluids. MR fluids can be used to improve or develop new brake systems, seat suspensions, robotics, clutches, airplane landing gear, and vibration damping systems. Research in this area furthers the development of a fledgling technology in which the viscosity of a fluid is changed by applying a magnetic field. The ability to change viscosity allows dampers to be optimized in real time according to the magnitude and frequency content of disturbances. For example, intelligent damping systems, to protect buildings and bridges during earthquakes and which modify their damping characteristics by changing the viscosity of the damper's working fluid may be enabled by this technology. Current damping systems are limited because they use a fluid whose viscosity cannot be easily changed, and hence their design must assume a given disturbance. Some variable viscosity damping systems have been developed for damping buildings and bridges. This investigation seeks to further that

technology to make such systems more effective and economical. Another application of changing viscosity in response to disturbance characteristics is in vehicle shock absorbers. Vehicle shock absorbers may be made more effective by varying the fluid viscosity, resulting in smoother rides or better performance on rough roads or terrains. InSPACE sample runs were conducted inside the Microgravity Science Glovebox (MSG) facility during Increment 6 and completed on Increment 7.

CSLM (Coarsening in Solid-Liquid Mixtures)

The nominal objective of this investigation is to obtain data on the steady state coarsening behavior of two-phase mixtures in microgravity. The data is used to determine the dependence of the rate constant, particle size distribution, and particle spatial distribution on the volume fraction



CSLM-2 Sample Chamber (white) and Control Unit installed for orbital operation in the MSG

of the coarsening phase. However, due to not have operational refrigeration, in combination with degradation due to sample age and processing constraints, the on-board samples did not produce science; rather the two CSLM samples were used for engineering and hardware checkout/verification during Inc. 7. Unexpectedly high humidity readings from one of the samples prevented its being used in the the engineering testing.

PFMI (Toward Understanding Pore Formation and Mobility During

Controlled Directional Solidification in a Microgravity Environment)

The objective of this investigation is to promote the understanding of the detrimental porosity formation and its mobility during controlled directional solidification in a microgravity environment. PFMI melts samples of a transparent modeling material succinonitrile and succinonitrile water mixtures. Investigators will be able to observe how bubbles form in the samples and study their movements and interactions. The PFMI investigation is conducted inside the Microgravity Science Glovebox (MSG) facility. Part of the sample set was completed on Increment 5. The operational goal for Increment 7 is to process as much as possible of the remaining sample set.

EarthKAM

Earth Knowledge Acquired by Middle school students (EarthKAM) activities kicked-off Increment 7 activities by acquiring 1832 images of student selected Earth features, which were downlinked and distributed to students of 26 schools. EarthKAM takes pictures by remote operation from the ground, without crew interaction. It is available for Middle School students, who submit image requests and conduct geographic research. The requests are uplinked in a camera control file to an SSC (station support computer) laptop, which then activates the camera at specified times and receives the digital images from the camera's storage card on its hard drive, for subsequent downlink via OPS LAN. EarthKAM's second session for



Remote-controlled EarthKAM camera installed in ISS window

7 Research

Increment 7 was working with students from ten schools and teachers participating in educator seminars who are looking to include EarthKAM operations in their classrooms. 819 images were taken for this EarthKAM Session. Both the students and teachers exhibited an overwhelming interest and have helped EarthKAM become a great success. All EarthKAM photos can be seen at <http://earthkam.ucsd.edu>

Earth Observations

NASA has teamed up with several educational institutions to revive the adventures of Lewis and Clark. Two hundred years ago, Lewis and Clark's expedition gathered vital information about America's previously undocumented land, resources and native inhabitants while facing unknown elements – similar to ISS. The "The Lewis and Clark's Travels, the Astronaut View" payload will acquire images of sites along the Lewis & Clark route. The images will help correlate space science, geology, geography, history, and literature. Interactive displays containing the images will give a different perspective of the magnitude of the Lewis and Clark expedition. Website reference: <http://www2.cet.edu/iss/>

café/articles/lewisandclark.asp

Human Life Sciences Investigations

Another successful HRF/Space Medicine Ultrasound activity was performed during Increment 7. The ultrasound video quality generated in this session was sufficient for effective remote guidance and image capture for both clinical capabilities and potential research purposes. Recordings of downlinked video test patterns, imaging video, and still images were analyzed in order to assess ultrasound downlink quality, image degradation, and to compare ultrasound data products. This was the first demonstration of the ability to conduct remote guidance to/from the Telescience Support Center (TSC) which has great potential for future HRF research experiments, and also as a backup resource for Space Medicine objectives. The session was also successful in reinforcing that remote guidance allows excellent quality images to be obtained even without extensive ultrasound training and experience. Another Ultrasound activity is scheduled for later this Increment. We expect these sessions to open the doors to using the HRF Ultrasound for future scientific investigations.

Important Announcements

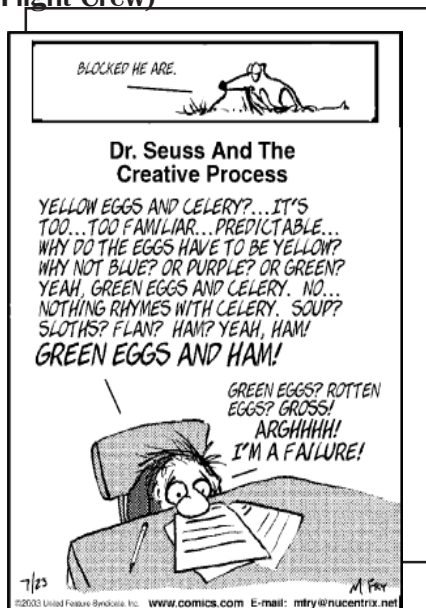
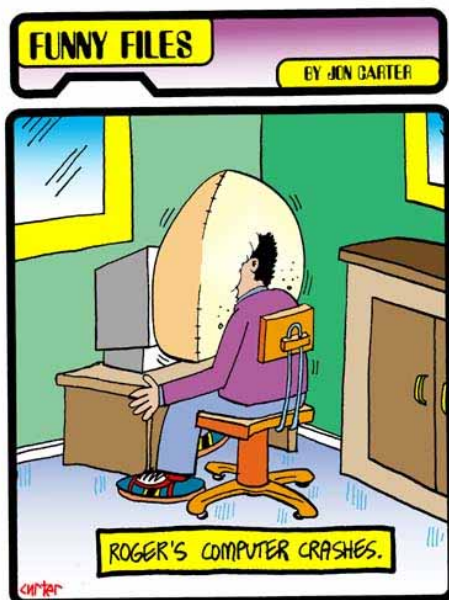
ISS PAYLOADS OFFICE WELCOMES NEW LEAD INCREMENT SCIENTIST

A recent addition to the Payloads Office is Dr. Janice Voss, who began an 18-month rotation from the Astronaut Office on August 18. She will be the Lead Increment Scientist for Increments 8 and 9, replacing John Uri, who is now the Acting Manager of the Research Planning Office. We very much look forward to working with Janice, in particular learning from her perspective as a five-time flyer with lots of experience operating science experiments.

EXPRESS USER'S TELECON

The EXPRESS Rack Users' Telecon is held every other Wednesday at 8:30 a.m. Central Time. This forum provides an opportunity for open communication on all topics related to EXPRESS integration. Current ISS Program information is discussed, along with updates to schedules, requirements (IDD) and integration processes. Payload Developers are also encouraged to bring up issues and concerns that may affect the EXPRESS payload community. Mike Danford, EXPRESS Integration Project Manager, sponsors this forum, and regular participants include the Payload Integration Managers, KSC Physical Integration, Payload Mission Integration and Planning and Payload Engineering Integration personnel. If you are an EXPRESS Payload Developer and not already involved with the User's Telecon, please contact Scott Motz (scott.w.motz@boeing.com) to be added to the meeting announcement distribution list.

HUMOR TO ORBIT (Ground Crew to the Flight Crew)



Quote for the Day:

Estimated amount of glucose used by an adult human brain each day, expressed in M&Ms: 250 - Harper's Index, October 1989

Increment 8: Maximizing Science; Minimizing Upmass

By Mike Read, ISS Increment 8 Payloads Manager

The stand down in the Shuttle program after the loss of Columbia last February presented the ISS Payloads program with a number of challenges. The effort to maintain a credible science program onboard ISS through minimal upmass is daunting enough. However, when coupled with the fact that no power on ascent is available, and all "up rides" are on Russian vehicles with certification processes different from our own...well, you start to get the picture.

The Expedition 8, Expedition Commander and Station Science Officer Michael Foale, and Soyuz Commander Alexander Kaleri, are scheduled to launch on 7 Soyuz (7S) on October 18, 2003, and return on May 5, 2004, for an increment duration of 199 days. In addition, European Space Agency astronaut Pedro Duque of Spain will accompany them to the Space Station on 7S. The current flight sequence for Increment 8 includes the 7S crew rotation flight, 13 Progress (13P) (Nov. 20, 2003), 14P (Jan. 30, 2004), and 15P (Mar. 25, 2004).

At present, we have payloads manifested on 7S and 13P, and expect manifests for 14P and 15P from the Research Planning Working Group in the near future. Total US payload mass manifested on 7S totals approximately 17 kg (about 40% of the total US manifest), and 102 kg on 13P (more than 50% of the total US manifest). It is important to understand that, while our payload requirements have been included in the integrated US manifest request provided to the Russians, the combined manifests for each of the above flights have not yet been approved by them. There are significant challenges to flying on these flights, not the least of which is the payload hardware making the deliverable milestones—some of which had already passed at the time the payloads were manifested.

To put the integration schedule being implemented for these flights into perspective, the nominal template calls for the baseline payload manifest to be ap-

proved by the RPWG at Increment-16 months—the 7S manifest and the majority of the 13P manifest were approved by the Payloads Control Board at 1-2.5 months! This was in response to July direction from Bill Gerstenmeier to sub-allocate 20 kg of the US allocation on 7S and 100 kg on 13P to ISS Utilization. The RPWG moved quickly, issuing a call for candidates that met very stringent criteria (hardware availability, no ascent power required, limited mass and volume required, etc.) and building a list of manifest candidates to be added to these flights. Additionally, OC (ISS Mission Integration and Operations Office) has worked hard to accommodate these payloads in the appropriate position in the overall manifest priority list. Although we have added a significant list of payloads very late in the flow, we are cautiously optimistic that we will actually get them flown.

Russian Integration

As mentioned, certification for flight on Russian vehicles requires a different process. Welby Redwine, our resident "gray beard" Flight Payload Manager, has the job to ensure that our payload developers are aware of this process and to assist them and their Payload Integration Managers in any way necessary to facilitate the process. In addition to different documents and processes, there are other challenges ahead. Namely, agreements must be negotiated to allow US payloads that contain biological samples (ADSEP-SPEGIS, ADSEP-CEMSS, and Yeast-GAP) to be received and flown, and a separate bilateral agreement made for the on orbit operation of the Renal Stone experiment. Igor Savelev, our Russian Payload Manager, is working with the Russians and OC to get these agreements in place in time to make the flights. Finally, since ISS Utilization does not meet the criteria stated by the Russians for flight on their vehicles during the time Shuttle is not flying (i.e. items critical to ISS or items required for safety reasons), a separate accord must be reached.

Research Overview

The following investigations are planned for Increment 8:

Code M

Educational Payload Operations (EPO-8); Earth Science Toward Exploration Research (ESTER); Synchronized Position Hold, Engage Reorient, Experimental Satellites (SPHERES); Crew Earth Observations (CEO); Earth Knowledge Acquired by Middle Schools (EarthKAM).

Fundamental Biology

Advanced Separation by Phase Partitioning-S. pneumonia Expression of Genes in Space (ADSEP-SPEGIS); Advanced Separation by Phase Partitioning-C. elegans as a Model Organism for Space Flight (ADSEP-CEMSS).

Human Life Sciences

Foot/Ground Reaction Forces during Space Flight (FOOT); Renal Stone risk during Space Flight (Renal); Journals; Interactions; Hand Posture Analyzer (HPA); Advanced Ultrasound; in addition to a number of preflight and post-flight investigations.

Physical Sciences

Protein Crystal Growth-Single Thermal Enclosure System (PCG-STES); Space Acceleration Measurement System II (SAMS-II); Microgravity Acceleration Measurement System (MAMS); Cellular Biotechnology Operations Support System-Fluid Dynamic Investigation (CBOSS-FDI); Binary Colloidal Alloy

Test-3 (BCAT-3); Capillary Flow Experiment (CFE); Dust Aerosol Measurement Feasibility Test (DAFT); Study the structure of a viscous liquid foam (FOAM); Fluid Merging Viscosity Measurement (FMVM); Pore Formation and Mobility (PFMI).

Space Product Development

Yeast-Group Activation Pack (Yeast-GAP).

Accessing POIC Services

By Kim Langford

In response to several questions regarding access information, the following article is an attempt to summarize the process for accessing the services provided by the Payload Operations Integration Center (POIC) to the PD/PI Teams.

Following the approved Ground Support Requirements Teams (GSRT) Ground Data Services timeline, the establishing of new user accounts begins at the Increment -10 months (I-10) milestone. For ISS resource utilization planning and crew procedure development, user accounts are established around I-15. The question is "How do I get there from here?"

What are POIC Services?

POIC Services are services provided to ISS payload customers such as commanding, telemetry/science data distribution, payload health and status distribution, mission planning tools, crew procedures, mission operations voice communications, and payload operations information management systems. These services are provided by MSFC's POIC. Payload Operations teams can remotely access these services.

How do I request POIC Services?

Once your experiment is manifested, your Payload Integration Manager (PIM) will assist you through the ISS processes. After your high level ground support requirements have been baselined in your Payload Integration Agreement, you will use your Payload Data Library (PDL) account, provided by your PIM, to submit the details of your requirements in your Ground Data Services data set. If you have questions concerning services you can visit the GSRT Web site for more information -

<https://payloads.msfc.nasa.gov/gsrt>.

As listed on the GSRT Web site, MSFC's Ground Support Requirements (GSRT) points of contact will assist you through the process of identifying the

POIC services that best suit your ground operations concept.

How to get access to POIC Services?

The Huntsville Operations Support Center's (HOSC) Operations Planning and Integration Team will contact you once your ground support requirements are identified in PDL's Ground Data Service (GDS) data set and baselined by MSFC's Payload Operations Control Board (POCB). This team will also electronically provide all the necessary forms that must be completed prior to accessing POIC services.

What forms will I have to complete and why?

Completion of some or all of the following forms is required prior to accessing POIC services. The HOSC Operations Planning & Integration team (contact numbers are on the GSRT Web site) will assist you with form completion. These forms are required to comply with NPG 2810.1, Security of Information Technology as well as Technology Transfer, and Export Control policies. They are as follows:

1. HOSC Account Request Form. All customers using POIC services must complete this form. It is used to identify the accounts on all POIC systems used to service your ground operations needs. The Account Owner will be required to sign the form acknowledging that they are responsible for all team members using the assigned accounts and that all team members will abide by NASA's ITS requirements. The form is also used to ensure the POIC has the appropriate software licenses necessary to service your accounts.
2. Pass Code Form. All team members must complete a Pass Code Form. This form is used to establish a User Authentication Code that the POIC will use when assisting your team members with

account needs. This code, like banking system PIN numbers, will be used by our Customer Support personnel to authenticate users' identity before assisting in password resets, and other typical account questions. This is for your protection so unauthorized users won't have access to your account and associated privileges.

3. Site Security Checklist. All operating locations accessing POIC services must complete this checklist. This checklist identifies your facility's compliance with NASA ITS security policies. The checklist identifies ITS documentation (i.e., ITS Security Plan) required by your operating location before access is granted to POIC services.
4. Software User Agreements. All customers accessing POIC software, will be required to sign a Software User Agreement (SUA). This form is used to remind the customer that they are using NASA provided software and the software may not be redistributed to any organization without formal approval from NASA. These forms will be required for each new major delivery of POIC software, so you may be asked to sign additional versions through the lifecycle of your payload operations activity. Forms are currently required for access to the POIC's Enhanced HOSC System (EHS), Internet Voice Distribution System (IVoDS), and the EHS Personal Computer (EPC) system.

What happens after I complete and return all the forms?

You will be contacted by the HOSC Operations Planning & Integration team and provided your account names. You will then contact HOSC Customer Service (HCS) (256-544-5066) to receive your passwords. HCS is also available to assist with configuring your systems to access POIC services.

Payload Operations and Integration

Increment 7

Carmen Price

The Expedition 7 crew has completed many of their science mission objectives. This includes the completion of the Microgravity Science Glovebox (MSG) InSPACE payload, two Education Program Office (EPO) payload demonstrations, and EarthKAM Operations. The middle schools students took over 800 pictures during EarthKAM Operations! The crew has also performed one of two Human Research Facility (HRF) Ultrasound checkouts. The Ultrasound checkout was a joint effort with the Medical Operations community. This is the first on-orbit activity connecting multiple centers and the implementation went extremely smoothly thanks to the work of the folks at JSC and MSFC. The next major milestones are the undock of 11P and the arrival of 12P. 11P is currently scheduled to undock on August 28. 12P is scheduled to launch on August 30 and dock with the ISS on September 1. The Increment will come to its conclusion with the launch of 7 Soyuz on October 18.

Increment 8

By George Norris

Increment 8 is no longer an "Option"! The Expedition crewmembers, Commander Michael Foale and Flight Engineer Alexander Kaleri are in the final phase of their preflight training. Increment 8 will begin with the launch of 7 Soyuz, planned for October 18. It will encompass 3 Progress flights and will be completed with the undock of 7 Soyuz on May 5, 2004.

As the manifests for the Soyuz and Progress flights are being finalized, we are focusing on encompassing the payloads requirements in our preflight operations products. Development of training products, procedures and timeline models will be our major focus. Due to the shortened template that we are operating under, we will be relying heavily on On-Board Training to accomplish the objectives.

Prep for ULF1

Arthur Werkheiser

The POIC cadre continues to have a meeting every 2 weeks to discuss pre-Increment preparation for ULF1. With the announcement of a reasonable and possible launch date of March 11, we are moving forward. As of today, no crewmembers are named to the flight. No official manifest exists. But we realize that any manifest will be a derivative of the old manifest, since significant mass will be added to our orbiter: robotic arm and tile repair kit.

With these data points in mind, the logical steps to take are as follows: Leave the crew procedures (PODF) baselined but open the interim User Requirements Collection (iURC) models to be changed without ECR (Unbaselined). The rationale for leaving crew procedures baselined is that payloads will likely only be deleted, not added, therefore changes to crew procedures should be minor. This also allows us to start training a crew as soon as they are named. The iURC models are normally opened at L-6 months, so this will put us back on template and provide the PDs an avenue for change with less paper work.

MELFI is still the top priority rack of this mission. The WORF rack is on the low-end priority and is at great danger of falling off the manifest, but product development continues until we know for sure if the rack will be demanifested. The POIC is still pursuing improved MELFI operations by working with the PD team to strengthen the functional checkout and also use the "autoprocures" function of Timeliner to speed recovery of MELFI ops from power cycles (planned and unplanned). Training and simulations continue for all cadre members.

Increment 12A.1

Eric Melkerson

In July, Increment 12A.1 completed part 1 of the 12A.1 Flight Operations Review (FOR). Due to the complexity of the mission and launch dates moving out, it

was decided to break the FOR into two parts to provide the operations team additional time to better choreograph a very complex flight. The FOR was chaired by DA8/John Curry and Phil Engelauf, the Lead Station and Shuttle Flight Directors for 12A.1. Payload Operations and Integration (PO&I) coordinated the review from the perspective of the 12A.1 payload developers. In all, 15 Discrepancies Notices (DNs) were submitted from PO&I and were approved against the STS-116/12A.1 Flight Rules, Assembly Operations Procedures, and Flight Plan.

September will bring the 13A FOR. Similar to Flight 12A.1, part 1 of the FOR will consist of a subset of documents normally reviewed in a Flight's FOR. Primary focus of this review will be the Flight Rules, Assembly Operations Procedures, Payload Regulations, EVA Flight Supplement and Systems Procedures. Flight 13A adds the S3/S4 truss (solar array), the opposing solar arrays to the P3/P4 truss (solar array) launched on 12A.

POIC Mission Planning and PEI Data Consistency

Ross H. Armstrong

The POIC Mission Planning and the Payload Engineering Integration (PEI) offices have been working together to ensure consistency between data used in PEI-generated stage analyses and operational planning data collected in the iURC tool. Consistency between engineering analysis and planning data is essential to ensure effective payload operations. The Payload Integration Process Improvement effort resulted in an action to verify that consistency was present between engineering and planning products. In response to this action, a power and thermal table was generated comparing iURC planning data and PEI verification data by payload. Increment ULF-1 was already working through the established requirements gathering processes and was chosen as the starting point for coordination and resolution of the data.

Through much diligent work, success is near after several key issues were

(see **Payload Ops** page 11)

Payload Ops

(continued from Page 10)

identified and corrected. For example, instances arose where iURC requirements were documented by the payload for cases in which verification data were not present. This resulted in additional verification testing to ensure that the requested case would meet Station requirements and that the iURC data were accurate. In addition, the nominal operational scenarios tracked by iURC and verification were varied for several of the ULF-1 payloads. Breakdown of the scenarios allowed the teams to identify the individual hardware operating during that timeframe, resulting in updates to submitted data.

This process has been challenging at times, but PEI and Mission Planning have quickly learned how to understand the differences between iURC collected data and verification data. Through the coordination and information exchange process, the products generated by both teams will be more accurate, reflecting consistency throughout the engineering analysis and operations planning phases. This will ensure that the same data used to generate stage analysis and guidelines and constraints is also used to develop plans and schedules for ISS payload operations.

Many thanks go to the ULF-1 payloads that have cooperated with us as we worked through this process for the first time. They will be happy to know that reflight payloads will not be re-assessed unless their power and thermal data change in the future. This process will be conducted for new payloads on an increment basis with continued coordination between POIC Mission Planning and PEI.

Automated Procedure Run a Major First for International Space Station Payload Operations

By Mark McElyea

On June 10, a significant milestone for ISS operations was achieved. The first Automated Procedure using the Charles Stark Draper Laboratories product called Timeliner was successfully executed. An Automated

Procedure referred to as a "Bundle" in the Timeliner language issued the first Payload Startup Notification and later Payload Shutdown Notification commands for the Microgravity Science Glovebox payload.

According to Angie Haddock, lead operations engineer for Timeliner at the POIC, "This major accomplishment represents the first step in establishing Timeliner as a reliable, routine method for monitoring and commanding payloads onboard the ISS." Howard Stetson, the lead application programmer for the bundle that was executed was exuberant. He stated, "We are starting with very simple commands and payload functions to gain experience with the system and its capabilities, before moving into more complex operations. Timeliner, when used to its full capability, will maximize the operational efficiency of ISS for the Payload Developer (PD)."

Early in the Space Station Program, ground controllers for payloads and core systems recognized that an Automated Procedure capability onboard was highly desirable. This capability was needed to automate procedural tasks for flight crew and ground operators and reduce the complexity of flight software and ground operations. In 1992, NASA selected Timeliner as the Automated Procedure capability for Space Station. The Timeliner application is executed on the Space Station's real-time core command and control and payload control computers known as Multiplexer-Demultiplexers. Currently, it is planned for use on the ISS for U.S. core operations, U.S. payload operations, and Japanese core and payload operations.

The Timeliner system is both a specialized computer language and an execution environment. Within the POIC, the Timeliner system includes a compiler application accessible by the PD through the Payload Information Management Systems (PIMS). The Timeliner language was specifically designed to allow easy definition of "bundles" that provide sequencing and process control of complex systems. Onboard, the compiled "bundles" are executed under the control of the Timeliner Executor on the Payload Multiplexer-Demultiplexer (PLMDM)

computer. The execution environment provides real-time monitoring and control based on the commands and conditions defined in the Timeliner language. The Timeliner language allows the definition of payload "bundles" that perform time tagged execution of commands, event monitoring, telemetry parameter monitoring, branching logic, and response to crew or ground controller commands.

Historically, Timeliner was created to emulate the timelines for onboard crew procedures followed by the crew of the Space Shuttle. It was used as a simulation driver in tests of the Space Shuttle system, mimicking crew actions in monitoring and controlling spacecraft systems. This version of Timeliner has been in use since 1982. In general, the Timeliner system lowers the workload in the performance of mission or process control operations. In a mission payload system control, process control as needed by materials processing experiments, handling of failure detection and recovery, and response to significant events detected through on board telemetry. Timeliner is excellent for implementing procedures that need to be clearly defined by a systems specialist and executed reliably, insuring repeatability. Since Timeliner allows multiple, parallel automated sequencing, multiple operations can occur simultaneously, utilizing ISS crew members for only the 'human required' activities (e.g. replacing filters, exchanging components, etc.) Also, since much of the sequencing is provided autonomously, Timeliner holds the potential to reduce the crew and ground operations training required providing a significant savings in mission cost. Also, the use of the Timeliner provides significant improvements to mission success, reliability, and safety since human sequencing errors are eliminated (e.g. steps executed out of order, duplicated, or omitted, incorrect command parameters, improper evaluation of system data, etc.). PDs interested in finding out more about Timeliner and its potential use for their payload should contact Angie Haddock at 256-544-6285 or

angie.haddock@nasa.gov.

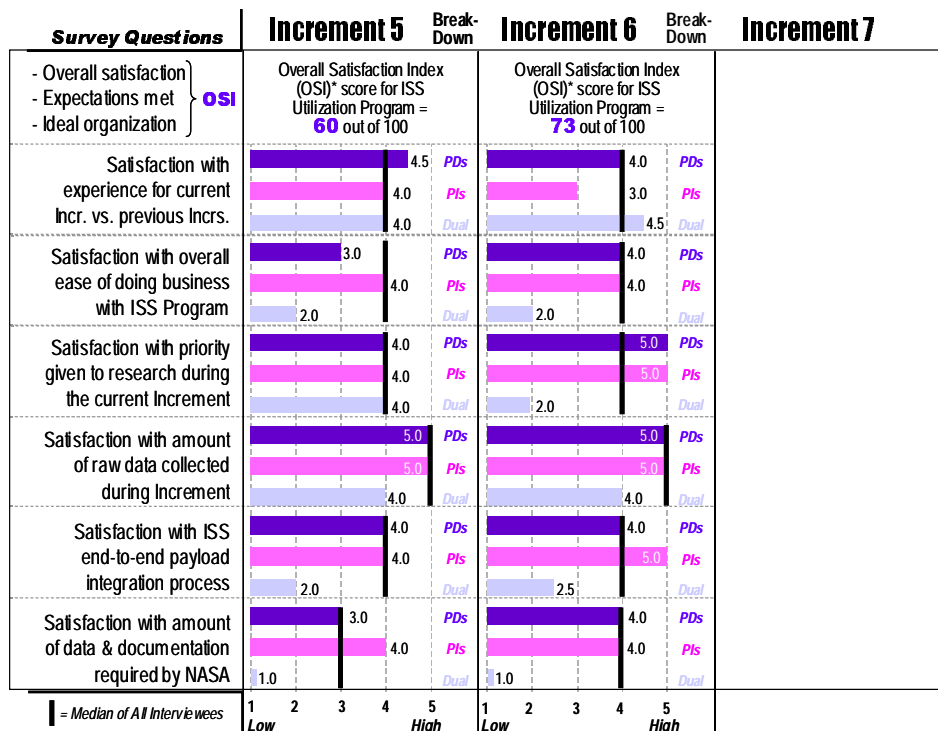


Mick Culp, Editor
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The second round of customer interviews was recently completed. Results are being analyzed by the Payloads Office and will be compiled in a final report in September.

The figure to the right provides a preliminary peak at the median values of ratings given by Payload Developers (PDs) and Principal Investigators (PIs) and dual role PDs/PIs in response to selected questions from the ISS Utilization Survey and compares results with responses to the same question after Increment 5.

Customer Satisfaction Overview



* OSI is obtained by taking basis question ratings on a 1 to 10 scale, converting to 0 to 100, and then averaging.

ISS Research Postflight Reports CD Available

By Catherine Jett

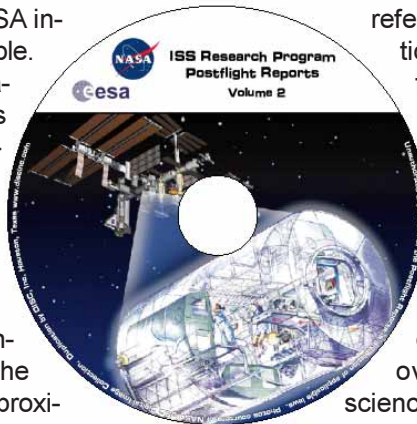
Conducting science on ISS is challenging! Just ask any Payload Developer (PD) and they will tell you that it takes a lot of effort to conduct an experiment on ISS. There are hardware/software design reviews, hardware testing, crew training, baseline data collection, many requirement submittals and, lest we forget, real time operations on Station. But in the end, the PDs will tell you that they were happy to have the opportunity to conduct science in zero-g.

After an investigation is completed, each investigation's Principal Investigator (PI) has the opportunity to share preliminary observations, typically limited to reporting the completion of on-orbit operations and any unexpected operational difficulties, in Post Flight Reports. The Mission Science group consolidates these reports and releases them on CD to all interested parties.

The ISS Research Program Postflight Reports, Volume 2 CD, with science

reports from ESA and NASA investigations, is now available.

This CD contains an Operational Accomplishments Report for most of the investigations through Inc. 6. An Operational Accomplishments Report is the first postflight report submitted by an investigator, and contains background information and status of the science. It is submitted approximately 30 days after the end of a mission or expedition. The accomplishments report typically does not contain scientific findings or conclusions. In addition to experiment reports, the CD also contains graphics such as mission patches and crew photos. Several photos taken from ISS or Shuttle are also included, as are select photos of some of the science hardware. Many websites pertaining to the experiments and to space research in general are listed for



reference and information. The CD is intended for space researchers to learn about other investigations conducted aboard ISS, and can also be of interest to scientists outside of NASA, since an overview of all ISS science is easily attained.

The investigations are organized by ISS Partner, and also by Expedition such that the user clicks on the desired link in either Table of Contents. This CD is the second in a series of ISS Postflight Report CDs. If you have not received a CD by September 1 and would like one, a CD can be obtained by sending an email to Catherine Jett at catherine.s.jett@lmco.com. Please include your name and mailing address in the email.